

We Claim:

1. A method for encoding signals to be transmitted from a plurality of transmitting antennas comprising the steps of:

mapping a block of bits, having a duration T , into a first vector;

5 processing said vector with a set of mutually orthogonal vectors and a delayed symbols vector to develop a current symbols vector;

delaying said current symbols vector by said duration T ;

mapping said current symbols vector with a space time coder to develop a plurality of signals; and

10 applying said plurality of signals to said plurality of antennas.

2. The method of claim 1 where said plurality of transmitting antenna comprises more than one antenna.

15 3. The method of claim 1 where said plurality of transmitting antennas comprises more than two antennas.

4. The method of claim 1 where said duration T has p time slots, said mapping develops p sets of n signals, and said step of applying applies a different one of said sets on n signals during each of said p time slots.

5. The method of claim 4 where said step of processing computes,

$$S_{u+1} = \sum_{l=1}^k P_{wl} v_l(S_u),$$
 where P_w is said first vector, P_{wl} is the l^{th} element of P_w , and the sequences $v_1(S_u), v_2(S_u), \dots, v_k(S_u)$ belong to said set of mutually orthogonal vectors.

6. The method of claim 5 where $k=4$, and said mutually orthogonal vectors are
 $v_1(S) = (s_1 \ s_2 \ s_3 \ s_4)^T$, $v_2(S) = (s_2 - s_1 \ s_4 - s_3)^T$, $v_3(S) = (s_3 - s_4 - s_1 \ s_2)^T$ and
 $v_4(S) = (s_4 s_3 - s_2 - s_1)^T$, S being a vector that is applied to said mutually orthogonal vectors.

7. The method of claim 5 where $k=3$, and said mutually orthogonal vectors are any three of $v_1(S) = (s_1 \ s_2 \ s_3 \ s_4)^T$, $v_2(S) = (s_2 - s_1 \ s_4 - s_3)^T$, $v_3(S) = (s_3 - s_4 - s_1 \ s_2)^T$ and $v_4(S) = (s_4 s_3 - s_2 - s_1)^T$, S being a vector that is applied to said mutually orthogonal vectors.

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8. The method of claim 1 where said space time coder employs a complex constellation set and develops a transmission rate of one half.

9. The method of claim 1 where said space time coder employs a real constellation set and develop a transmission rate of one.

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10. A method for receiving signals that were transmitted in accordance with claim 1, comprising the steps of:

receiving signals in blocks;

processing signals to develop a first vector, R_u , for each block u ;

developing a vector \mathcal{R} having n elements $R_{u+1} R_u^q *$, where R_u^q corresponds to R_u processed with sequence $v_q(R_u)$, which is a q^{th} member of a set of receiver sequences that are mutually orthogonal, for all values of $q=1, 2, \dots, n$, where n is a preselected number;

performing minimum distance detection on said vector \mathcal{R} to develop therefrom a vector P ; and

applying a mapping to said vector P to obtain a block of bits.

11. The method of claim 10 where n equals number of antennas in said plurality of transmitting antennas.

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12. The method of claim 10 where said mutually orthogonal receiver sequences are the same as the orthogonal vectors employed in said method of claim 1.

13. A method for receiving signals that were transmitted in accordance with claim 1, comprising the steps of:

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receiving signals in blocks in each of an m plurality of receiving antenna;
 processing signals of each receiving antenna to develop a first vector, R_u ,
 associated with said each receiving antenna, for each block u ;

developing a vector \mathcal{R}^j for each receiving antenna, j , said vector having n
 5 elements $R_{u+1} R_u^q *$, where R_u^q corresponds to said first vector R_u processed with sequence
 $v_q(R_u)$, which is a q^{th} member of a set of receiver sequences that are mutually orthogonal,
 for all values of $q=1, 2, \dots, n$, where n is a preselected number, thus developing m \mathcal{R}^j
 vectors;

summing said m \mathcal{R}^j vectors to obtain a summed vector \mathcal{R} ;

10 performing minimum distance detection on said vector \mathcal{R} to develop therefrom a
 vector P ; and

applying a mapping to said vector P to obtain a block of bits.

The method of claim 10 where said $m > 1$ where said step of receiving is receiving blocks
 of signals in each of a plurality of receiving antennas, and said step of developing a
 15 vector

14. A method for receiving signals that were transmitted in accordance with
 claim 1 by a transmitter having more than two transmitting antennas, comprising the
 steps of:

20 receiving, through m receiving antennas, where $m=1$ or more, signals in blocks;
 detecting signals transmitted in each block by processing received signals of said
 each block with aid of processed signals of immediately previous block.

15. The method of claim 14 where said step of detecting excludes consideration
 25 of parameters between said transmitting antennas and said receiving antennas.